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Abstract

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Keywords

gender, self-reported effort, interest, self-efficacy, mathematics, science, achievement, Asian Indian

Disciplines

Educational Psychology | Feminist, Gender, and Sexuality Studies | Industrial and Organizational Psychology
| Multicultural Psychology

Comments

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Abstract

We examined the role of self-reported effort in predicting chemistry and physics achievement after controlling for prior achievement, gender, mathematics/science self-efficacy and interest. The data were collected from two Asian Indian high school samples. Self-reported effort was hypothesized to be the most salient predictor of achievement given its important role in the Asian Indian culture. Based on prior findings it was also hypothesized that gender would moderate the effect of interest on achievement. Both hypotheses were supported. After other key variables were controlled (prior achievement, gender, and mathematics/science self-efficacy and interest), self-reported effort was a significant predictor of both chemistry achievement and physics achievement. Moreover, gender did moderate the relation of interest and achievement. Boys who were more interested in physics and chemistry achieved higher scores, but girls' level of interest did not correlate with their achievement.

Keywords: gender, self-reported effort, interest, self-efficacy, mathematics, science, achievement, Asian Indian.

Predicting Science Achievement in India: Role of Gender, Self-efficacy, Interests, and Self-reported Effort

High school students' achievement in the sciences has received ongoing attention over the past decade as exemplified by cross-national large-scale standardized testing efforts (Gonzales et al., 2008; OECD, 2010). Traditionally, the sciences are highly valued in Asian cultures, and they lead to high status occupations (e.g., Li, 2003; Malaki, Soriano, & Valdez, 2009; Sue & Okazaki, 1990). The purpose of this study was to examine self-reported effort as a predictor of science achievement of high school students in India. Considering the value placed upon excelling in the sciences, it is surprising how little research has been devoted to predictors of science achievement. Moreover, the studies that have addressed this question have focused predominantly on Western countries.

In order to study science achievement, it is important to understand how this construct and its antecedents are defined within a given cultural context. Culture influences the specific variables that are salient in predicting academic performance. For example, in India effort may be more salient than academic confidence in predicting science achievement (Dandy & Nettelbeck, 2000). Hard work and persistence are highly valued in Asian cultures, especially within the domain of formal education. Children are strongly motivated to work hard, and achievement is attributed more to effort than to ability. Therefore, many Asian parents view below-par performance as an indicator of insufficient effort (e.g., Ho & Hau, 2008; Magno, 2010; Stankov, 2010). Moreover, to report strong confidence in one's academic ability may be muted because of the Asian value of humility or being self-effacing whereby children learn to attribute success not to ability but to hard work (e.g., Kim & Park, 2006).

One purpose of this study was to examine the predictors of physics and chemistry high school achievement in India while controlling for prior achievement in these areas. Since this

question has not yet been examined in an Asian context, we chose to focus our attention on a culturally relevant variable, namely self-reported effort. Within the vocational psychology literature effort has rarely been examined.

Academic self-efficacy is a core construct in the prediction of achievement and reflects its importance in the American context. As early as 1981, Hackett and Betz provided evidence that increasing girls' confidence was related to succeeding academically in traditionally masculine domains like mathematics and the sciences. Self-efficacy is purported to directly influence science achievement and indirectly influence it through performance goals (Lent, Brown, & Hackett, 1994). Self-efficacy is also thought to increase both effort and interest in the sciences, but these two constructs have rarely been examined for their influence on achievement within the self-efficacy literature. Interest has been examined more frequently as a predictor of occupational choice.

We have set a high standard in examining the effect of these variables by controlling for prior achievement, by examining all key variables simultaneously, and by employing a longitudinal design. Moreover, we have focused on two core science domains, namely physics and chemistry. Vocational psychology scholars have paid little attention to the prediction of academic achievement in general, and science achievement in particular. In the next section, the relevant literature regarding each of these constructs will be reviewed. Due to the scarcity of literature within vocational psychology, much of the studies cited are from educational and developmental psychology using mostly samples from the United States and Western Europe. We will primarily focus on predictors of science achievement, but we will also include mathematics achievement given the importance of mathematics in chemistry and physics.

Gender, Self-efficacy, and Interests

Gender, self-efficacy, and interest primarily serve as control variables for the prediction of academic achievement in this study and were included based on their salience in the vocational literature; they are briefly reviewed in order. There seems to be no gender differences

in mathematics achievement when assessed in the classroom (e.g., Marsh, Trautwein, Lüdtke, Köller, & Baumert, studies 1 and 2, 2005). The very small gender differences that do exist are found on standardized mathematics national examinations (Academic College Testing [ACT], 2010). When turning specifically to science achievement, the evidence is mixed. Denissen, Zarrett, and Eccles (2007), based on a large sample in the United States, provided evidence that girls had higher science grades than boys in grades 1 through 12. However, based on the most recent 2010 ACT report, boys were shown to perform slightly better than girls on the science reasoning section (ACT, 2010). Finally, in a British sample, no gender differences in science grades were observed at age 16 after controlling for achievement assessed two years earlier (Frederickson & Petrides., 2008). In short, the evidence for gender differences in science achievement appears to be inconclusive.

Mathematics and science self- concept have been examined as predictors of science and mathematics performance. Both mathematics and science self-concept and self-efficacy use subjective non-normative self-ratings and are used interchangeably in this paper. Robbins and colleagues in their *Psychological Bulletin* meta-analysis of grade point average (GPA) also used them interchangeably (Robbins et al., 2004). In the Robbins meta-analysis, academic self-efficacy contributed 3.3% of the variance in GPA after controlling for prior achievement. Mathematics self-concept predicted mathematics achievement after controlling for prior achievement (Marsh et al., 2005). Only one study was located that controlled for prior science achievement (Zeegers, 2004). Zeegers showed that academic self-efficacy had a direct effect on biology performance after three years but not after one year. Though not controlling for prior achievement, two related studies examined self-efficacy and science achievement with conflicting results. Denissen and colleagues (2007) found science self-concept to be linked to science achievement; Spinath and colleagues did not find a significant relation of self-efficacy and science achievement (Spinath, Spinath, Harlaar, & Plomin, 2006).

Recent studies from predominantly Western countries have shown that mathematics interests predict mathematics achievement (Denissen et al., 2007; Köller et al., 2001). Likewise, science interest has been shown to predict science achievement (Denissen et al., 2007; Salta & Tzougraki, 2003).

Self-reported Effort

As noted earlier, effort has particular relevance in Asian cultures (e.g., Li, 2003; Malaki, Soriano, & Valdez, 2009; Sue & Okazaki, 1990). However, effort has been rarely examined as a predictor of achievement, and no studies were located that controlled for prior achievement. For the purpose of this study, we measured effort through self-reported study time which is similar to the way Chow (2007) measured effort. Chow found a positive association between effort and general academic achievement; other researchers also found positive associations between effort using a diary (George et al., 2008) and academic achievement. Only one study was located that examined self-reported effort and mathematics achievement. Ho and Hau (2008), using an Asian sample from Hong Kong, showed that self-perceived effort positively correlated with mathematics achievement. No studies were identified that measured self-reported effort as a predictor of science achievement.

Gender, Self-efficacy, Interests, and Self-reported Effort

One strength of this study lies in the simultaneous examination of self-reported effort along with mathematics/science self-efficacy and interest. Little research has addressed the simultaneous effect of gender, mathematics and science self-efficacy and interest, and self-reported effort on mathematics or science achievement after prior achievement has been controlled. Only one study was found in which any two of these constructs were examined together as predictors of achievement. Marsh and colleagues (2005) demonstrated that when mathematics self-concept and mathematics interest were entered together in a multiple regression, only mathematics self-concept was predictive of mathematics grades.

Gender and Interests

Researchers have acknowledged the influence of socialization on boys and girls with regard to their science and mathematics achievement. One way in which socialization is noticeable is through gender differences in interests. Scholars have noticed that girls perform similarly to boys in mathematics and sciences courses (e.g., Denissen et al., 2007). However, girls are somewhat less interested than boys in mathematics as shown in Western samples (e.g., Bailey, Larson, Borgen, & Gasser, 2008; Frenzel, Goetz, Pekrun, & Watt, 2010; Köller et al., 2001; Marsh et al., 2005). Likewise, girls appear to be somewhat less interested in the sciences compared to boys in Western countries (e.g., Bailey et al., 2008; Francis and Greer, 1999; Hoffman, 2002). In addition, some preliminary results suggest that the interest-achievement correlation may be smaller for girls than for boys in predominantly Western samples (e.g., Denissen et al., 2007; Hoffmann, 2002; Schiefele, Krapp, & Winterler, 1992).

The Present Study

The literature on the prediction of science achievement is scarce. Moreover, the role of time reported studying in the prediction of science achievement is unclear, and the available research has almost exclusively been conducted in Western countries. However, achievement and the factors that contribute to it are culturally bound and may be different in a non-Western context. Much has been written about the emphasis of achievement in an Asian context (e.g., Li, 2003; Malaki, Soriano, & Valdez, 2009; Sue & Okazaki, 1990). We also know that some of the best performing schools in the mathematics and science domains are in Asian countries (e.g., OECD, 2010). Asian parents emphasize achievement over socializing during the adolescent years and the curriculum reflects those values (e.g., Ho & Hau, 2008; Li, 2003).

In the present study, we were primarily interested in examining the salience of time reported studying in predicting science achievement after prior achievement, gender, and mathematics/science self-efficacy and interest have been controlled. Specifically, we have focused on two core science courses that are essential to the pursuit of many STEM careers, namely physics and chemistry. The context we have chosen is a high school population of 11th

grade physics and chemistry students in India. The first hypothesis was that self-reported effort would predict chemistry and physics achievement at a later time after controlling for prior achievement, gender, mathematics/science self-efficacy and interest. The second hypothesis concerned gender as a moderator of the relation between interest and achievement. We anticipated that the correlation between interest and achievement would be significantly lower for girls than for boys. Given the focus on self-reported effort as a predictor after controlling for the other variables and the focus on the interaction of gender and mathematics/science interest, a hierarchical multiple regression was chosen as the most appropriate statistical analysis (Wampold & Freund, 1987).

Method

Participants

The population was 11th grade physics and chemistry students in India who had completed their end of year 11th grade examinations and who remained enrolled through their 12th grade to complete their midyear 12th grade examinations. This population of students constituted 50% of the student body.

The final sample consisted of 82% of the physics and chemistry students. The participants were 249 Asian Indian high school students from a large urban area in India. The overall sample consisted of 49.4% female students and 50.6% male students. The average age of the students was 16.2 years ($SD = 0.4$ years) with a range of 16 to 18 years. The sample was drawn from all 11th grade students who were taking physics and chemistry. In India, the placement of students in physics and chemistry classes is based on students' performance on the yearly 11th grade standardized examination. The percentage of students completing a science curriculum in this sample is typical of urban high schools in India. All of these students had been required to take English for many years and were considered fluent in spoken and written English. Also, English was the medium of instruction in the classes.

Criterion Variable: Time 2 Physics and Chemistry Achievement

Subsequent academic achievement (achievement at Time 2) was measured by students' 12th grade half-yearly national examination scores for physics and for chemistry. Half-yearly examinations are comprehensive mid-year examinations (held in December every year) that include material taught over the span of one half of an academic year. The scores can range from 0 to 60 points. These national examinations are used in high schools throughout India.

Predictor Variables

Time 1 physics and chemistry achievement. Prior academic achievement (achievement at Time 1) was defined as the students' 11th grade final subject examination scores in chemistry and in physics. The 11th grade annual examinations are comprehensive, occur at the end of the year in June, and cover material taught over the span of one academic year. The score range is 0 to 60 points. These examinations are used in high schools throughout India.

Mathematics and science self-efficacy and interest. The mathematics/science subscale of the Fouad-Smith Scales for Subject Matter Specific Social-Cognitive Constructs (FSS; Smith & Fouad, 1999) were used to operationalize mathematics/science self-efficacy. Smith and Fouad combined the two domains into one scale; given the importance of mathematics in physics and chemistry, the combination of both domains seemed like an excellent choice.

The self-efficacy subscale of the measure included five items each for science and mathematics. Students indicated their response to the prompt "I feel confident that with the proper training I could perform [activity]" on a 6-point Likert scale ranging from 1 = *very strongly disagree* to 6 = *very strongly agree*. An example item was "I could design and conduct a science experiment." Several items were edited to reflect an Asian Indian sample. For example, "I could earn an A in a math course" and "I could earn an A in a science course" was changed to "I could earn more than 75% in a science (math) course" because above 75% is the highest merit category. The subscale score was calculated by averaging the responses across all items, which resulted in a response range of 1 to 6. Higher scores indicated a higher level of mathematics/science self-efficacy. Cronbach's alpha for the combined mathematics/science self-

efficacy subscale reported by Smith and Fouad (1999) was $\alpha = .85$. In the current sample, internal consistency was estimated at $\alpha = .78$.

The interest subscale of the measure included 15 items for science, and four items for mathematics. A sample of an interest item was "Working with plants and animals." Students were asked how much they like to do each of the activities. Each item was reported on a six-point Likert scale ranging from 1 = *very strongly dislike* to 6 = *very strongly like*. The interest subscale is scored by averaging the individual item scores, hereby yielding a score range of 1 to 6, with higher numbers reflecting a higher level of interest. Smith and Fouad (1999) reported an internal reliability coefficient for the combined mathematics/science interest subscale as $\alpha = .94$. The internal consistency coefficient in the current sample was $\alpha = .88$.

Smith and Fouad (1999) used confirmatory factor analysis to examine the factor structure of the subscales. The results indicated that a model specifying the constructs as independent factors provided the best model fit. Smith and Fouad (1999) reported a correlation between mathematics/science self-efficacy and interest as $r = .53$, which is consistent with Lent et al.'s (1994) theoretical model.

Time reported studying. Students reported the number of hours per week spent studying for their classes.

Procedure

The second author was given permission to enter all the 11th grade physics and chemistry classrooms and to address the students collectively about the study. Students were informed orally and in writing about the purpose and procedures of the study. They were given parental consent forms to take home to their parents. Five school days after the initial visit, the researcher returned to each of these classes and handed out a packet containing an informed assent form as well as the measures used in the study to students who had signed parental consent forms. Very few students did not return signed parental consent forms. The survey questionnaire was written in English and was administered in a classroom setting; participants took on average 30 minutes

to complete the survey. The researcher collected the materials and gave the students a letter of debriefing. After receiving informed assent and parental consent in writing, the researcher obtained the school records of the students' examination scores from the two time periods. The first examination had occurred about one month prior to the surveys being completed. The second examination occurred six months later.

Results

Means, standard deviations, and zero-order correlations for the six variables are shown in Table 1. Two hierarchical multiple regression analyses were performed, one for chemistry and one for physics, with student achievement at Time 2 in these areas as the criterion (see Table 2 for an overview of the model parameters and their estimates). The predictors were entered in the following order: In Step 1, student achievement in chemistry (physics) at Time 1. In Step 2, gender, mathematics/science self-efficacy, and mathematics/science interest were added to the model. In Step 3, time reported studying, was added to the model. In Step 4, the gender by mathematics/science interest interaction was added to the model as well as the other gender interaction terms (gender by mathematics/science self-efficacy, gender by time spent studying). The three interaction terms were created by computing the products of the standardized predictors (mathematics/science self-efficacy, mathematics/science interest, and time spent studying) with the moderator variable (gender). All continuous predictors were standardized in order to reduce multicollinearity among the main effects and the interaction terms (Cohen, Cohen, West, & Aiken, 2003; Frazier, Tix, & Barron, 2004).

Main Effect of Prior Achievement: Step 1

The hierarchical regression analyses for predicting student achievement in chemistry and physics at Time 2 based on the performance in the respective domain at Time 1 yielded a significant positive correlation as shown in Table 2. Students who had earned higher scores on their chemistry achievement test at their 11th grade yearly exam in June also tended to score higher on the 12th grade half yearly exam in chemistry, which was administered six months after

the initial assessment. Likewise, higher achievement in physics at the initial assessment was linked to higher scores on the second physics achievement test. Overall, achievement at Time 1 explained about 27% (chemistry) and 39% (physics) of the variance in the test scores at Time 2.

Main Effects of Gender, Mathematics/Science Self-efficacy and Interest: Step 2

Three predictors were added simultaneously in the second step of the hierarchical regression analyses; these were gender (as a dummy-coded categorical variable), mathematics/science self-efficacy, and mathematics/science interest. For both chemistry and physics, these predictors together explained 4% and 5% of variance in the respective Time 2 test scores beyond the contribution of achievement at Time 1 as shown in Table 2. In both cases the only significant predictor of achievement at Time 2 was student gender. Female students had significantly higher scores ($M = 37.8/60$ correct for chemistry and $M = 36.3/60$ correct for physics) than male students ($M = 32.9/60$ correct for chemistry and $M = 28.4/60$ correct for physics).

Main Effects of Time Reported Studying: Step 3

The first hypothesis was examined in Step 3 of the hierarchical regression and is shown in Table 2. For both chemistry and physics, time reported studying explained a significant proportion of variance in the respective Time 2 test scores beyond the contribution of achievement at Time 1, and gender, mathematics/science self-efficacy, and interest. Time spent studying contributed 10% of the variance in chemistry achievement at Time 2 and contributed 3% of the variance in physics achievement at Time 2. Students who reported that they exerted more time studying also received higher achievement scores in both subjects. These findings support the first hypothesis.

Interaction of Gender and Mathematics/Science Interest: Step 4

Three interaction terms (gender by mathematics/science self-efficacy interaction, gender by mathematics/science interest interaction, and gender by time spent studying interaction) were added to the previous predictors in Step 4 of the analyses. For both chemistry and physics, the

interaction terms explained a significant proportion of variance in Time 2 test scores beyond the contribution of the predictors in the previous step as can be seen by Table 2. For both subject areas, there was a significant gender by mathematics/science interest interaction (see Figure 1), meaning that gender moderated the relation between interest and the achievement scores at Time 2. As can be seen by Figure 1, the students' mathematics/science interests which can range from 1 to 6 was visually displayed relative to how well they performed on their half-yearly national examinations with a possible score of 60 for both chemistry and physics. For male students, higher mathematics/science interest was associated with higher achievement scores at Time 2 in physics ($r = .28, p < .01$) and chemistry ($r = .31, p < .01$). For female students, however, there was no relation between their mathematics/science interests and their Time 2 achievement in chemistry or physics ($rs = .04, ps > .05$). These findings support the second hypothesis.

Discussion

As expected, the amount of time that high students in India reported studying was significantly predictive of their subsequent achievement in physics and chemistry after prior achievement and mathematics/science self-efficacy and interest was controlled. Moreover, boys in India who were more interested in chemistry and physics achieved higher scores. However, for girls in India there was no correlation between their level of interest and their achievement in these domains. The following discussion will focus on these two main findings.

Role of Self-reported Effort

Self-reported effort was a salient predictor of science achievement in this high school sample in India. This was expected based on the superordinate role attributed to effort in the Asian education context (e.g., Li, 2003; Malaki, Soriano, & Valdez, 2009; Sue & Okazaki, 1990). The results are consistent with Chow (2007) using the same operational definition of effort. These results are also similar to Ho and Hau's (2008) findings which showed that effort measured with four survey items correlated with mathematics achievement in a sample of Taiwanese 7th graders. It may be that effort in an Asian context reduces the influence of self-

efficacy and interest when predicting achievement. Asian Indian children are socialized to put forth considerable effort, while their subject-specific confidence and corresponding interests are given much less attention (e.g., Ho & Hau, 2008; Magno, 2010; Stankov, 2010). If the present findings can be replicated in future research, it might be warranted to examine the role of effort more closely when applied within an Asian context. Given the scarcity of findings regarding effort and science achievement in the United States, it is unclear to what extent these findings would generalize to U.S. high school science students.

Gender – Interest Interaction

Perhaps the most intriguing finding in the present study was the differential relation of interest and achievement in chemistry and physics for the boys and girls as displayed in Figure 1. Boys did better if they were more interested in these domains. Girls performed equally well regardless of their interest in these subjects. These findings are in agreement with other scholars who have reported differential correlations by gender (e.g., Denissen et al., 2007; Hoffmann, 2002; Schiefele, Krapp, & Winterler, 1992).

Scholars have proposed that the smaller relation between interest and achievement for girls may be due to sociocultural norms. Girls are expected to do well across subject domains regardless of their level of interest. In contrast, boys may be expected to focus their energies on what they are passionate about, thus ensuring that they will do better in those courses that are of greater interest to them (Hoffmann, 2002; Reeve & Hakel, 2000, Schiefele, Krapp, & Winterler, 1992). These results need to be replicated; the results suggest that girls may need to be encouraged to access their passion and boys may need to be encouraged to excel despite their wavering interest in the school subject.

Other Variables

In this sample, girls outperformed boys on the comprehensive national examinations in physics and chemistry at both time points. The effect size was almost one half of a standard deviation for both subjects. Prior evidence suggests that girls tend to outperform boys in the

classroom (e.g., Denissen et al., 2007) but the reverse seemed to be true for standardized national tests (e.g., Marsh et al., 2005). Mathematics/science self-efficacy and interest did not emerge as significant predictors of achievement in chemistry and physics when other variables were controlled. Our results are consistent with Spinath and colleagues (2006) who did not find science self-efficacy to be predictive of achievement after intelligence was controlled. As shown in Table 1, mathematics/science self-efficacy correlated significantly with prior achievement in chemistry for both sexes; self-efficacy correlated significantly with prior achievement in physics but only for boys. Other studies also found a significant relation of science achievement and science self-concept when not controlling for other variables (e.g., Denissen et al., 2007). Also, as shown in Table 1, interest correlated significantly with achievement for boys but not girls. These findings were discussed in the prior section. Future researchers will need to continue to examine mathematics/science self-efficacy and interest as predictors of science achievement simultaneously across different cultural groups and age ranges.

Implications for Academic Counseling

This sample applies most closely to counselors working in India with high school students. For these counselors, time spent studying may be important to discuss with them. In our sample, the average amount of time spent studying expended outside of class was reported to be 41 hours a week or 5 to 6 hours daily. Time spent studying may also be helpful for counselors in the United States to consider as well when discussing students' academic success. Especially for international students, they may have been tracked in their secondary education based on their academic performance in mathematics and the sciences. Some of these students may have been socialized by parents, families, and the larger culture to devote a considerable amount of time to their studies, and to perhaps deemphasize their interest and confidence in particular domains. Conversely, American students may have been socialized to emphasize interest and confidence over time spent studying. Counselors would want to tailor their assistance to match the unique values of the students they are serving.

Counselors may find it helpful to examine potential differences in how girls and boys are socialized to achieve academically. It is possible that boys may be more likely to achieve in domains that they are interested in whereas interests may not play a significant role in girls' achievement. This means that counselors would interpret boys' academic success in certain domains as more likely to be a source of information about their interests while they may not be able to make the same interpretation for girls.

Limitations and Future Directions

One limitation of this study is that the participants were from a large city in India. Rural samples across India should also be examined to ensure the generalizability of the findings. Also, these results are specific to one Asian country and specific to two domains, namely chemistry and physics. Our results need to be cross-validated in other Asian countries beyond India, and future research should include a broader array of subject domains. Finally, the indicator of achievement was students' score on a standardized national annual exam, a common measure of achievement in many European and Asian countries. However, in the United States, course grades (e.g., grade point average) are more commonly used as indicators of student achievement. In the past, results have varied somewhat depending on the measure of achievement used (e.g., Marsh et al., 2005). Researchers who study achievement may want to consider effort more as a predictor of achievement. One limitation of this study was the use of a retrospective report of time spent studying. Future researchers will want to explore other definitions of self-reported effort. It appears that authors have used various definitions of self-reported effort ranging from retrospective reports to diaries to survey items with similar positive associations with achievement (e.g., Chow, 2007; George et al., 2008; Ho & Hau, 2008). Researchers may also want to explore possible interactions of interest and gender to fully explore how gender socialization may differentially relate to achievement. We encourage researchers to continue to expand the population and the domains studied. We also suggest that researchers use theory as a

guide, test multiple predictors of achievement simultaneously, test potential interactions, include prior achievement in their analyses, and use alternative definitions of self-reported effort.

Conclusion

This study examined key predictors of chemistry and physics achievement in a sample of high school students in India. Our study was unique in terms of the assessment of prior achievement, the use of a longitudinal design, and the consideration of multiple predictors of achievement simultaneously. The strength of this study lies in the attention to a neglected variable, namely effort while controlling for mathematics/science self-efficacy and interest. Prior vocational scholars have mostly ignored self-reported effort as a predictor of achievement. They have also paid little attention specifically to science achievement in particular. Vocational scholars have also been slow to examine potential interactions among key variables. We found evidence that interests and achievement may be differentially related depending on gender.

We contributed to the literature by sampling 11th grade physics and chemistry students in India. It is unclear whether our findings regarding effort would be supported outside of an Asian Indian context. We do know that effort is an important cultural value that is communicated to Asian Indian children by their parents. Also, the present study is the first step toward learning about the predictors of science achievement within a high school in India. The present findings may be useful to counselors working with Asian Indian students both in India and the United States.

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Table 1

Summary of Bivariate Correlations, Means and Standard Deviations for All Variables as a Function of Gender

Measure	1	2	3	4	5	6	7	<i>M</i>	<i>SD</i>
1. Phys T1	-	.59**	.66**	.58**	.27**	.15	.32**	43.7	10.1
2. Phys T2	.65**	-	.62**	.77**	.16	.04	.40**	36.3	12.3
3. Chem T1	.66**	.66**	-	.59**	.19*	.04	.25**	36.7	11.3
4. Chem T2	.46**	.59**	.45**	-	.11	.04	.43**	37.8	12.4
5. SE	.13	.15	.22*	.03	-	.45**	.07	4.57	0.76
6. Interest	.14	.28**	.24**	.31**	.24**	-	.17	4.46	0.88
7. StuTime	.15	.24**	-.05	.33**	-.03	-.03	-	41.72	14.88
<i>M</i>	41.1	28.4	34.9	32.9	4.16	4.60	41.85	-	-
<i>SD</i>	10.6	13.3	12.1	13.2	0.91	0.78	12.77	-	-

Note. Bivariate correlations for female students ($n = 123$) are presented above the diagonal, and bivariate correlations for male students ($n = 126$) are presented below the diagonal. Means and standard deviations for female students are presented in the vertical columns, and means and standard deviations for male students are presented in the horizontal rows. Phys T1 = Achievement in physics at Time 1; Phys T2 = Achievement in physics at Time 2; Chem T1 = Achievement in chemistry at Time 1; Chem T2 = Achievement in chemistry at Time 2; SE = mathematics/science self-efficacy; Interest = mathematics/science interest; StuTime = self-reported number of hours per week spent studying. Higher scores indicate higher achievement, self-efficacy, interest, and time reported studying, respectively. * $p < .05$; ** $p < .01$.

Table 2

Hierarchical Regression Analyses Predicting Achievement in Chemistry and Physics at Time 2

Chemistry						
Predictor	<i>B</i>	β	<i>t</i>	R^2	Adj.	ΔR^2
					R^2	
Model 1				.27	.27	
Achieve T1	6.8	.52	9.6***			
Model 2				.31	.30	.04***
Gender	4.6	.18	3.2**			
SE	-1.1	-.09	-1.5			
Interest	1.6	.13	2.2			
Model 3				.41	.40	.10***
Time spent studying	4.1	.6	6.39***			
Model 4				.43	.41	.02*
Gender*SE	1.8	.20	1.2			
Gender*Interest	-3.8	-.48	-2.7**			
Gender*Time spent studying	-1.5	-.19	-1.1			
Physics						
Predictor	<i>B</i>	β	<i>t</i>	R^2	Adj.	ΔR^2
					R^2	
Model 1				.39	.39	
Achieve T1	8.4	.63	12.6***			
Model 2				.45	.44	.05***
Gender	6.0	.22	4.5***			
SE	0.2	.02	0.3			
Interest	0.8	.06	1.2			

Model 3				.47	.46	.03***
Time studying	2.3	.17	3.6***			
Model 4				.49	.48	.02*
Gender*SE	0.2	.02	0.1			
Gender*Interest	-4.1	-.50	-.3.0**			
Gender*Time studying	0.3	.04	0.3			

Note. $N = 249$; Achieve T1 = Subject-specific performance achievement at Time 1; SE = Mathematics/science self-efficacy; Interest = Mathematics/science interest; Time studying = Number of hours per week reported studying; * $p < .05$; ** $p < .01$; *** $p < .001$.

Figure 1

Interaction of Gender and Mathematics/ Science Interest in Predicting Achievement